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(54) Ticket

(57) An electronic ticket for use in a transport system includes a memory 8, processor 6 and a radio transmitter and receiver 2 which enables the ticket to communicate with a target apparatus in any orientation. Passengers carrying the ticket can purchase credit at an appropriate station and this credit is stored in the memory. When using the ticket, information is transmitted between the ticket and a ticket apparatus to enable the fare to be debited. Reliability is improved since no contact is required between the ticket and apparatus.

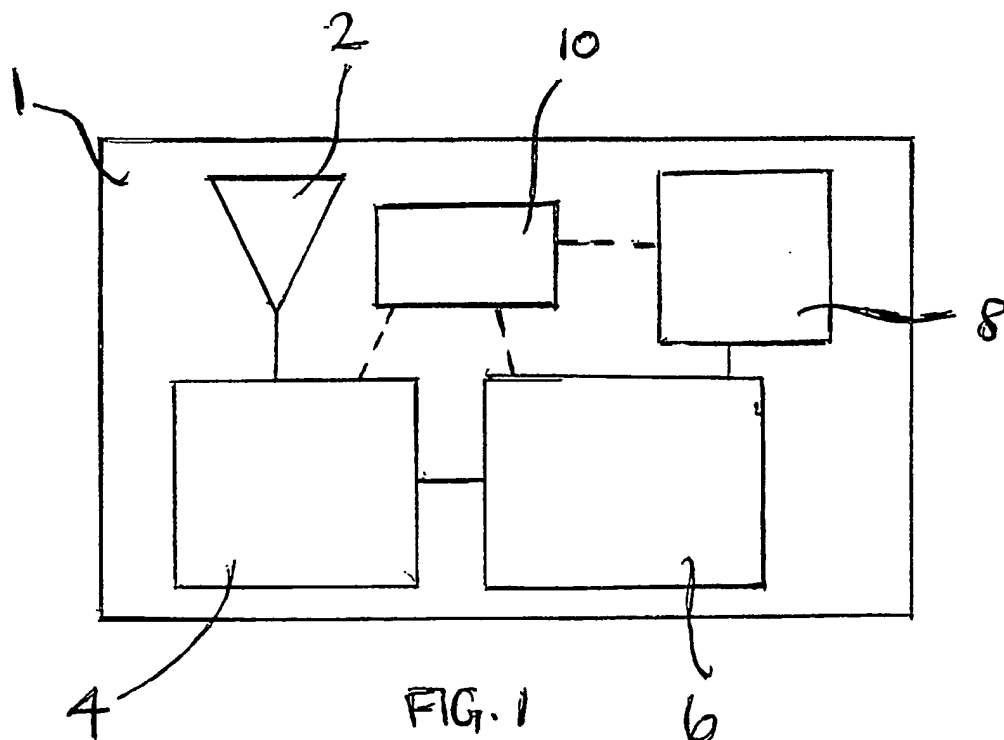
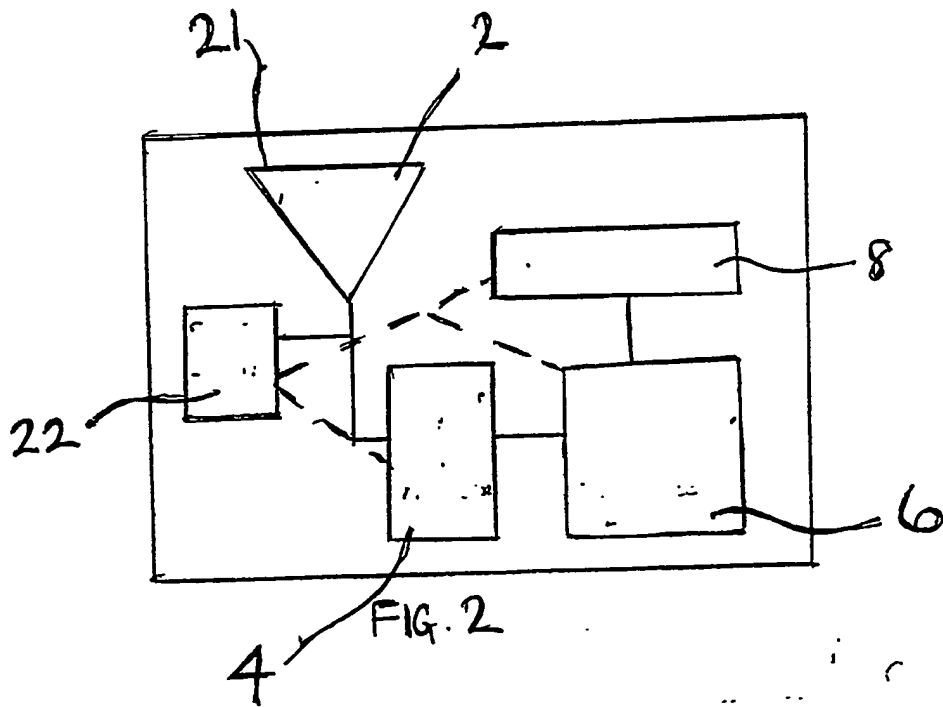
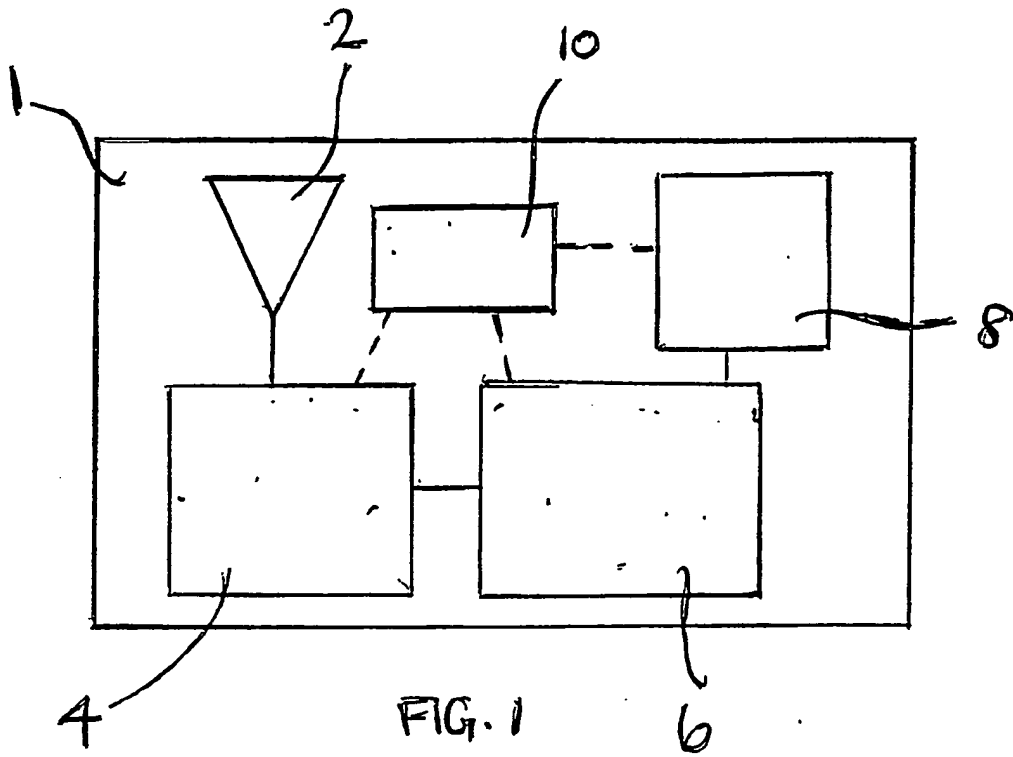


FIG. 1

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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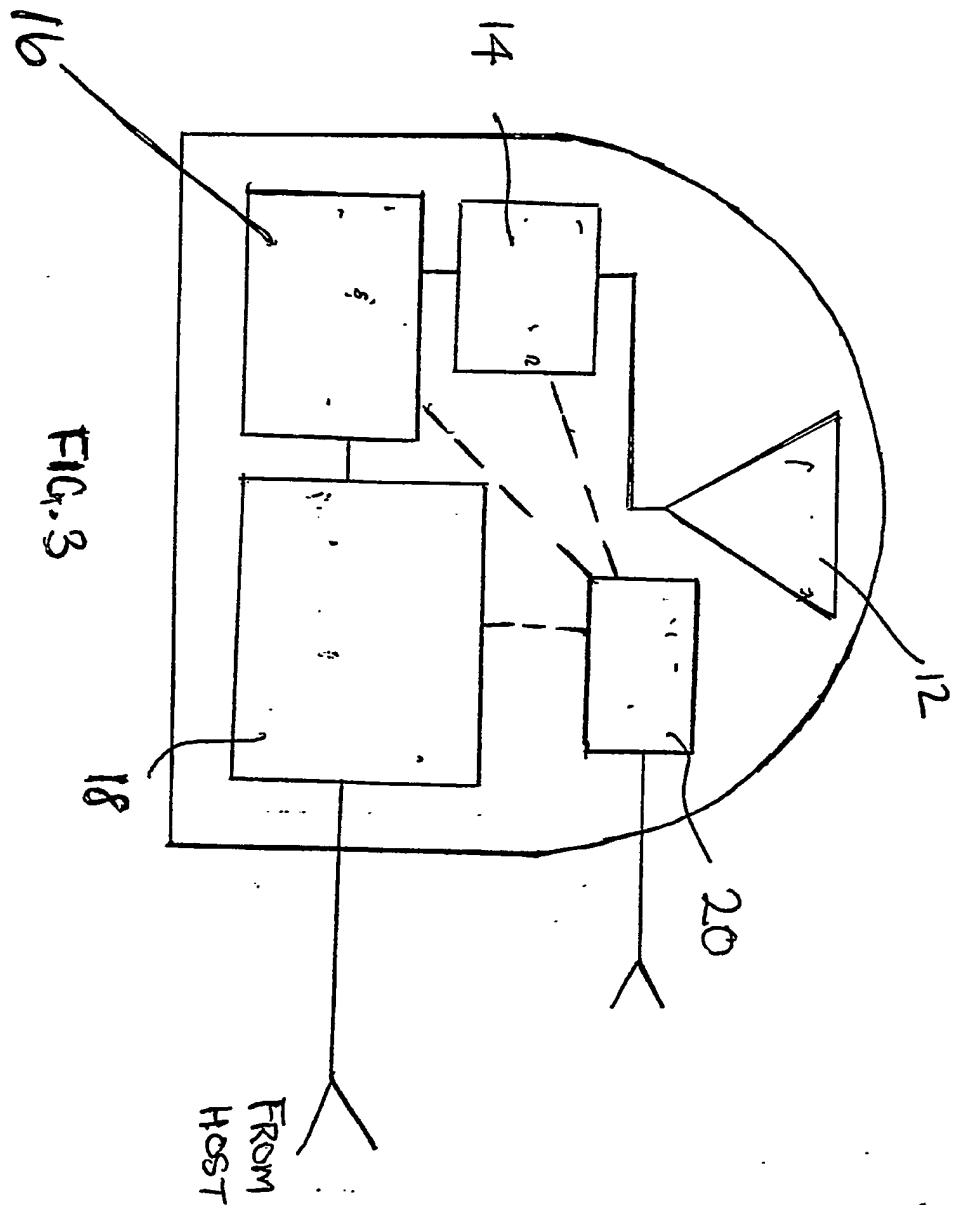


FIG. 3

# 2267626

- 1 -

## TICKET

5 This invention relates to a ticket for use with a  
transport system. In particular, it relates to an  
electronic ticket for use in an integrated transport  
system including buses and trains or the like, and to  
revenue collection apparatus for an integrated  
transport system incorporating such a ticket and a  
10 ticket reader means including a target device.

A person (passenger) making a journey from one place  
to another, for example from his or her home in a  
village to his or her place of work in a metropolitan  
15 area, by public transport may use several different  
modes of transport for various legs of the journey. A  
typical journey may commence with a walk to a bus stop  
prior to a bus ride to a railway station for a rail  
journey to a station in the metropolitan area. On  
20 arrival at the station the passenger's journey may be  
completed by a ride on a light railway, underground  
train or tram, a further bus ride, a taxi ride or a  
combination of the above.

Operators running transport services on the various legs of the journey have to be paid by the person travelling for their services. This may be done by advance purchase of one or more season tickets, by  
5 purchase of individual tickets for each leg of the journey or by a combination of the two. A passenger may need to carry one or more season ticket as well as cash for the journey. Also, where season tickets are valid for various different transport services, and  
10 where governments or the like subsidises travel, season ticket revenue and any government subsidies or the like are normally apportioned to the operators based on actual travel by passengers on the various services (passenger miles). It is one object of the  
15 present invention to simplify collection of fare revenue and apportionment of collected fare revenue to operators.

Season tickets have to carry various items of  
20 information. To avoid fraudulent use of the ticket by persons other than the season ticket holder, most season tickets are used in conjunction with an associated card which carries a photograph of the season ticket holder and his or her name. The season

ticket itself will show the journey on which and/or areas where, the season ticket is valid, the cost of the season ticket, and its date of expiry.

5       Some existing travel tickets include a machine readable magnetic strip which carries various of the above items of information. This information may be read when the ticket is passed through an automatic gate. The data on the strip is read, checked against  
10       fare and commercial rules tables, is re-encoded in accordance with the commercial rules, the new encoding is read and verified and the ticket is returned to the passenger. If the ticket is valid the gate is opened.

15       The London Underground transport system, utilises a system of magnetically encoded tickets and automatic gates as described above. However, although this system has advantages over mere visual inspection of a  
20       season ticket it has a number of drawbacks. The first of these is that the ticket is physically carried through a path in the gate for reading of the magnetic strips. This can damage the ticket. Also, the moving



parts of the reader means require frequent maintenance.

5 A second problem is that the use of automatic gates is not practical for use on other components of the London Transport system, particularly buses for reasons set out below, so when a season ticket holder gets on a bus to make a journey, his or her season ticket is visually inspected by the bus driver and  
10 although, this system is fast it is not very accurate.

One of the most important factors affecting the journey time of a bus which a bus operator may control  
15 (remembering that bus operators have no control over variables such as traffic conditions) is the "dwell time". This is the time that the bus is waiting at a bus stop while passengers board. In an ideal system to minimise the dwell time, the ticket processing  
20 time should equal the boarding time viz the time it takes a passenger to walk onto the bus. Any delay in issuing or processing tickets or processing passengers delays the bus and automatic gates are too slow.

On a bus, size constraints are significant since space is limited. Automatic gates are larger and there is little room to place one in a bus. Also the environment outside the bus is not controllable and is generally more hostile to equipment than a railway or underground station. This is particularly significant since on a bus there is only likely to be one item of ticketing/fare collection equipment and failure of that could put that bus out of service. Automatic gates are not sufficiently robust and reliable for use on buses.

The present invention seeks to alleviate some or all of the above mentioned problems and provide an improved electronic ticket for a transport system which is particularly suitable for use on buses.

In a first aspect, the present invention provides an electronic ticket comprising a memory, data processing means, radio transmitter and radio receiver means operably connected to an antenna said electronic ticket being capable of interacting with a target device operably connected to ticketing apparatus or the like, for the transmission of information between

the electronic ticket and the target device, the arrangement being such that the fare ticket and target device can transmit information from one to the other for, inter alia reading and rewriting data on the ticket with the ticket in any orientation with respect to the device and with the ticket spaced apart from the device.

The use of a radio transmitter to transmit information such as the ticket serial number, and whether the ticket is valid, from the ticket to the target device and for transmitting data from the target device for rewriting the ticket eliminates the need for contact between the target device and the ticket and improves reliability since no moving parts are needed in the target device. By using a sufficiently large antenna, preferably the size of the ticket, the ticket will operate at substantial distance, about 50-60mm or so, from the target device.

The target device will normally be connected to a ticketing apparatus such as a bus fare box. The box may include means to produce signals indicative of whether the ticket is valid for travel. Two tone

audible signals (one tone for a valid ticket, another for an invalid ticket) are preferred. Since this is quicker than visual inspection.

- 5 One important criteria for a ticket to have is a high percentage of "first pass acceptances" to say that the ticket does not require re-presentation to the target device. Acceptance failures can occur when a ticket and a ticket reader means are not in communication for
- 10 sufficiently long for the transmission of information concerning the transaction and the re-writing of data on the ticket to take place. To alleviate this problem, in one embodiment, the ticket may include a capacitor or battery to provide sufficient power to
- 15 allow the ticket to complete processing of a transaction even after communication with the target device has been broken.

- Many transport systems are "open" systems in which a
- 20 passenger's ticket is checked on entry to the system but not on exit (checking on exit is labour intensive and is impractical for buses). On such systems it is difficult to know how far a particular passenger has ridden or intends riding to allow for the accurate

deduction of fares and the accurate collection of data relating to "passenger miles".

5 The "honour system" involves a passenger declaring their destination at the start of their journey e.g. by telling their destination to a bus driver or buying a rail ticket as far as a particular destination. The only incentive apart from personal honesty which a passenger has to declare the correct destination is a  
10 fear of inspectors may check for the validity of their ticket either during at the end of their journey. Due to high labour costs and public relations problems, there tend to be few inspectors.

15 On buses, because of the critical nature of the "dwell time" checking on exit is not suitable so the "honour system" tends to be used.

To alleviate this problem, the electronic ticket of  
20 the present invention may include means for transmitting the ticket serial number only, a distance of a metre or so to the target device, so that the electronic tickets of passengers exiting a bus can be read by the reader means. It is only necessary that

the ticket serial number be readable at long distance since other relevant data is read and recorded on entry to the bus including the stated destination.

5 Any passengers who have travelled further than their ticket entitled could then be automatically notified and asked to represent their ticket to the ticket reader means to correct the error, could be logged for data correction purposes for subsidiary payment to the  
10 operator, or could be blacklisted if they were persistent offenders or any combination of the above.

The invention also encompasses apparatus for transport  
15 system revenue collection for an integrated transport system incorporating tickets according to the first aspect of the present invention and one or more target devices including an antenna arranged to transmit and receive data from the tickets linked to ticketing  
20 apparatus.

The invention will now be described by way of example only and with reference to the accompanying drawings in which:-

Figure 1 is a block diagram illustrating components of an electronic ticket embodying the first aspect of the present invention;

5

Figure 2 is a block diagram illustrating components of a further electronic ticket embodying the first aspect of the present invention;

10

Figure 3 is a block diagram illustrating components of a ticket reader means for use with the tickets of figure 1 and figure 2.

15

Referring to the drawings, an electronic ticket 1 includes an antenna 2 connected to a modulator and demodulator 4. The modulator and demodulator are connected to a microprocessor 6 which in turn is operably connected to a non-volatile memory 8. The modulator and demodulator 4, microprocessor 6 and memory 8 are powered by a battery 10. The various components are held in a flat plastic case (not shown) substantially the size of a credit card and

20

approximately 2.4mm thick. The case has a photograph or likeness of the holder of the electronic ticket marked on one of its faces.

5      Figure 3 shows a target device comprising an antenna  
12 operably connected to a power amplifier 14. The  
amplifier is connected to a modulator and demodulator  
16 which is itself connected to a microprocessor or a  
dedicated logic circuit 18. The power amplifier 14  
10    modulator and demodulator 16 and microprocessor 18 are  
powered by a power supply 20. The microprocessor is  
connected to ticketing apparatus which will include a  
memory to record transactions.

15    Figure 2 shows an electronic ticket 21 similar to that  
shown in figure 1 with components carrying the same  
reference numerals as similar components of figure 1,  
but which instead of a battery incorporates a power  
supply including a capacitor 22.

20

In use, passengers carry the tickets and the target  
devices are operably connected via an interface to  
ticket issuing machines, automatic gates, validators,  
bus fare boxes portable ticket checking equipment or



the like, where appropriate. When the ticket is presented to a ticket issuing machine the memory of the electronic ticket will be encoded with information such as whether the ticket is valid to travel in a particular area or how much money the electronic ticket is credited with if it is being used to purchase a ticket for a particular journey. The ticket is suitable for use with all commonly used fare structures including stored value, stored ride, passes with date validity and point-to-point/zone-to-zone travel.

When the ticket is suitably credited with a stored value, or validated as a season ticket it can be used by a passenger who can present it for example to a target device linked to an automatic gate.

In its normal state the target device generates a signal and its receiver listens for a response. Until the electronic ticket enters the field of the signal generated by the target device the ticket is inactive. However, once the ticket is brought into the signal range of the target device the target signal is received by the ticket which provides power to

energise the circuits of the ticket. The date in the non-volatile memory is read and transmitted to the target device (this is repeated every 50 milliseconds).

5

The target device then receives the data verifies the data integrity and sends a hold message to the ticket. The ticket receives the hold message and ceases data transmission for 100 milliseconds.

10

The target device then passes the received data through its interface and into the processor of the automatic gate. Data is checked to ensure it follows the fare table rules and data is regenerated for transmission to the ticket.

15

The ticket receives the new data and places this in the non-volatile memory. This is then validated and when found to be correct identifies the new data with a new data set bit. The ticket then sends in an acknowledgement message back to the target and goes inactive. The target device receives the acknowledgement message and passes a credit to the gate processor which opens the gate.

20

Power for the processing carried out in the ticket comes either from the target device or if communication is broken from the ticket's internal battery or capacitor (which stores energy from the antenna).

The operation of the ticket and target device follows the same principles in other applications for example when used on a bus in conjunction with a bus fare box instead of opening a gate the bus fare box may generate audible signals for the driver different signals depending on whether the ticket is valid or not.

On exit from the bus the target device may be arranged to activate the electronic ticket to transmit only the serial number to the target device. Because very little information needs to be transmitted this can be done over a relatively large distance say about a metre, to check that the passenger has not travelled further than he or she is permitted. This reading of the ticket serial number can be done automatically without the passenger taking any action. However, this "passive reading" of a ticket only informs the

driver that money may have to be deducted. If any alteration such as a reduction of the value of the ticket, is to be carried out the passenger will have to re-present the ticket to the target device within  
5 the 50-60mm range of the target device for reading and rewriting of the ticket.

The electronic ticket and target device provide speed, convenience and accuracy in revenue collection for  
10 transport systems. Because of the speed of operation and because of the lack of moving parts which means that the target device may be sealed to the elements, the system is particularly suited for use on buses.

15 Added benefits occur because the system dispenses with the need to insert tickets, tokens or coins into slots which is a particularly benefit to old infirm or disabled passengers. Also since communication between the target device and the ticket is by radio signal,  
20 there is no need for a passenger to actually remove his or her ticket from his or her wallet, it being sufficient to bring the ticket within the field of the target device.

CLAIMS:

1. An electronic ticket comprising a memory, data  
processing means, radio transmitter and radio receiver  
5 means operably connected to an antenna said electronic  
ticket being capable of interacting with a target  
device operably connected to ticketing apparatus or  
the like, for the transmission of information between  
the electronic ticket and the target device, the  
10 arrangement being such that the fare ticket and target  
device can transmit information from one to the other  
for, inter alia reading and rewriting data on the  
ticket with the ticket in any orientation with respect  
to the device and with the ticket spaced apart from  
15 the device.

2. An electronic ticket according to claim 1  
including a capacitor or battery to provide sufficient  
power to allow the ticket to complete processing of a  
20 transaction even after communication with the target  
device has been broken.

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3. An electronic ticket according to claim 1 or claim 2, including means for transmitting the ticket serial number only, a distance of a metre or so to the target device, so that the electronic tickets of passengers exiting a bus can be read by the reader means.

4. An electronic ticket according to any preceding claim, including visible means indicative of the identity of a user.

5. Apparatus for transport system revenue collection for an integrated transport system incorporating tickets according to any preceding claim and one or more target devices including an antenna arranged to transmit and receive data from the tickets linked to ticketing apparatus.

6. An electronic ticket substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

**Patents Act 1977**  
**Examiner's report to the Comptroller under**  
**Section 17 (The Search Report)**

-18-

Application number

GB 9210182.3

**Relevant Technical fields**

- (i) UK Cl (Edition L ) H4L (LASS, LACA, LADA, LACD, LACX)
- (ii) Int Cl (Edition 5 ) G06K 1/00, 1/12, 7/00, 7/10, 19/07; G07C 9/00; G07B 15/00, 15/02

**Databases (see over)**

- (i) UK Patent Office
- (ii) ONLINE DATABASE: WPI

**Search Examiner**

N W HALL

**Date of Search**

20 JULY 1993

Documents considered relevant following a search in respect of claims 1-6

Category (see over)	Identity of document and relevant passages		Relevant to claim(s)
X	US 4977501	(LEFEVRE) - whole document	1, 5
A, Y	EP 0465456 A1	(SOC REG WALLONNE) - whole document	3
A	WO 91/14237 A1	(CUBIC WESTERN) - whole document	-
X	GB 2246896 A	(TOSHIBA) - whole document	1, 5

Category	Identity of document and relevant passages	Relevant to claim(s)

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